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ABSTRACT

Some research indicates that individuals learn more when given control over their instruction, while other data suggests that individuals learn less effectively when given control over their instruction. This document describes a study which investigated the effects of matching university-level learners with the amount of instruction they prefer. Two hundred and three preservice teachers participated in the study. They completed a 10-item questionnaire about their preferences for high or low amounts of instruction. They were randomly assigned, sometimes according to preference and sometimes not, computer disks containing a "lean" or a "full" instructional program and told to complete the program within two weeks. Results include: (1) users of the full version scored higher on posttests than users of the lean version; (2) subjects who preferred a high amount of instruction had more positive attitudes toward the program than those who preferred lower amounts; (3) subjects assigned the lean version of the program generally had more positive attitudes than recipients of the full version; and (4) matching students to their preferred amount of instruction did not produce a significant difference in posttest achievement. Two appended tables illustrate the findings. (Contains 26 references.) (BEW)

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MATCHING LEARNER PREFERENCE TO PREFERRED AMOUNTS OF INSTRUCTION

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The idea of learner control over instruction has enjoyed increasing popularity as a result of the growth of computer-assisted instruction in the schools. Several researchers have investigated the effects of allowing learners to choose the amount of instruction and practice they desire as they progress through computer-assisted instructional programs (Carrier, Davidson, Williams, & Kalweit, 1985; Hicken, Sullivan, & Klein, 1992; Kinzie, Sullivan, & Berdel, 1989). Other researchers have explored learner control by matching student preferences for amount of instruction with the amount they receive (Freitag & Sullivan, 1994; Hannafin & Sullivan, 1994).

Research has yielded inconsistent results regarding the benefits of learner control on learner achievement. Some results indicate that individuals learn more when given control over their instruction. Ross, Morrison, & O'Dell (1989) reported that higher posttest scores were obtained by undergraduate education majors who were allowed to select the instructional presentation medium than by students who were not. Kinzie, Sullivan, & Berdel (1988) found that eighth-grade science students given control over reviewing content scored higher on a posttest than students who were not given this option.

Other research indicates that individuals learn less effectively when given control over their instruction. When encountering complex instructional material or lacking prior knowledge, Carrier et al. (1984) found that seventh-grade learners make poor instructional choices. Ross and Rakow (1981) reported that college students in an introductory sociology class who were given instructional control, but no guidance, also make poor instructional choices.

Carrier, Davidson, and Williams (1985) used the terms "lean" to refer to a program contains only the core elements of instruction and "full" to refer to a program that is more comprehensive. Freitag and Sullivan (in press) found that assigning college graduates to their preferred amount of instruction (lean or full) in a company training program produced increased achievement. Hannafin (1994) on the other hand, found that matching high school students with their preferred amount of instruction in a geometry program did not yield a significant difference in favor of matched subjects. He attributed the difference between Freitag and Sullivan's results and his own to two primary factors: the education and motivation levels of the subjects, especially the low-ability subjects in his study.

The purpose of this study was to further investigate the effects of matching subjects at the university level with the amount of instruction they prefer. These students represent a more advanced

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level of education than Hannafin's high school students. There is also evidence that the subjects in the course involved in this study are strongly motivated to perform well and receive a good grade (Igoe, 1993).

Subjects completed a computer-based instructional program that is approximately three hours in length. It was an integral part of the coursework in a required course. The principal research questions to be investigated were:

1. Do students who receive their preferred amount of instruction (lean or full) perform better than those who receive a contrasting amount?
2. Do students in the full treatment perform better than those in the lean treatment?
3. Do students who receive their preferred amount of instruction spend more or less time in the program than students who do not?
4. Do students who receive their preferred amount of instruction have more favorable attitudes towards the program than those who receive a contrasting amount?

Method

Subjects

Participants in the study were 203 preservice teachers, 39 males and 164 females, enrolled in their first semester of a professional teacher preparation program at a large southwestern university. Grade-point averages were obtained for all students in order to permit analysis of preference and performance by GPA.

Materials

The instructional content covered three topics (Worthwhile Objectives, Effective Instruction, and Assessment) in a total of 13 learning objectives. The three topics were presented in a computer-assisted program in the Macintosh Hypercard format for the study. The program tracked each subject's progress through the program on a screen by screen basis, recording each response choice.

In both versions, each of the 13 objectives was covered by a number of screens which present instruction, practice and feedback, and reviews. The number of practice items was varied for each objective between the lean and full versions. The full program included several practice items per objective and the lean program included an average of two items per objective. Information, examples, reviews, summaries, and practice quizzes were identical in both versions of the program. Practice items consisted of multiple choice questions with two to four response choices. An on-line attitude questionnaire was also included in both versions.

Procedures

Subjects completed a 10-item questionnaire to determine their preference for low or high amounts of instruction. Subjects with scores at or below the median score of 21 were classified as having a preference for a low amount of instruction, and those with scores above the median were designated as having a preference for a high amount of instruction. Subjects then were randomly assigned to a version of the program that either matched (low preference to lean version, high preference to full version) or did not match (low preference to full version, high preference to lean version) their self-reported preference for amount of instruction.

Each subject then received an individual program disk with his or her assigned version of the program. Instruction sheets with directions for using any of the available computer facilities on the university campus were included with the disks. Subjects were instructed to complete the program within two weeks and report back to the regular class session.

A 36-item posttest was administered in the first class session after the two week period. Program disks were also collected at this same class session.

Criterion Measures

The 36-item posttest was in multiple choice format and covered objectives in the instructional program. The posttest reliability, calculated using Cronbach's alpha on the entire sample in this study, was .83. The 10-item Likert-type attitude survey assessed subjects satisfaction with the material, perceived effort, desire for more information, continuing motivation and confidence in their posttest performance.

Design and Data Analysis

The study is a 2 (full or lean program) x 2 (matched or unmatched) posttest-only experimental design with random assignment of subjects to treatments. Analysis of variance (ANOVA) was used to analyze achievement and time data. Attitude questionnaire data were analyzed using a multivariate analysis of variance (MANOVA) followed by a univariate analysis.

Results

Results are discussed below by achievement, time in program, and student attitudes.

Achievement

The mean scores on the 36-item multiple-choice posttest are shown in Table 1. The mean posttest scores by program mode were 28.59 for subjects who received the full version of the program and 23.42 for subjects who received the lean version of the program. ANOVA revealed that this difference was statistically significant, F (1, 185) = 45.82, $p < .0001$. The mean posttest scores for matching condition were 26.12 for the matched condition and 25.86 for the unmatched condition, a nonsignificant difference. The program mode by matching condition interaction also was not significant. The overall mean scores across all subjects was 25.99 items correct (72 percent).

Attitudes

Responses to the 8-item attitude questionnaire, which was scored on a 1 (most positive) to 5 (least positive) basis, are shown in Table 2. The overall mean score across all eight items was 2.11, indicating generally positive attitudes toward the instructional program. MANOVA revealed a significant overall difference between groups for attitude scores, F (8, 178) = 2.08, $p<.05$. Therefore, follow-up univariate tests were conducted to determine differences on an item-by-item basis.

Table 2 reveals that subjects who preferred a high amount of instruction had more positive attitude scores than those who preferred a lower amount on all eight of the questionnaire items, and significantly more positive scores on five of the eight items. The five items on which there were significant differences revealed that high-preference subjects agreed more strongly than low-preference subjects that they would like to learn more about Competency Based Instruction, would tell other students to use the program, liked the program, would like to use a program like this one again, and would prefer a program that provided a lot of instruction and practice if they had to work on another computer program.

Table 2 also reveals that students in the lean program version had more positive attitudes toward the program than those in the full version, although the differences were significant on only two of the eight questions for program mode. Subjects who received the lean version responded significantly more positively than those in the full version to the items "The program was easy" and "I would tell other students to use this program if they wanted to learn more about Competency Based Instruction."

There were no significant program mode by learner preference interactions on the attitude items.

Time in Program

No significant differences for time-in-program were obtained for program mode or matching condition. The average time for completion of the program across all subjects was 2 hours 16 minutes. Subjects in the full version averaged 2 hours 23 minutes and subjects in the lean version averaged 2 hours 9 minutes. Mean times for matching condition were 2 hours 27 minutes for matched subjects and 2 hours 5 minutes for unmatched subjects.

Discussion

This study examined the effects of preference (matched or unmatched) and program mode (full or lean) on the achievement, time-in-program, and attitudes of university undergraduate students. Subjects who used the full version of the instructional program scored significantly higher on the posttest than those who used the lean version. However, matching subjects to their preferred amount of instruction, as measured by a questionnaire administered prior to the experimental phase of the study, did not yield a significant achievement difference over assigning subjects to their less-preferred amount. Subjects who preferred a high amount of instruction had more positive attitudes toward the program than subjects who preferred a low amount. Subjects who received the lean version of the program had more positive attitudes than those who received the full version.

Matching students to their preferred amount of instruction did not produce a significant

difference in achievement on the program posttest. This finding contrasts with results obtained by Freitag and Sullivan (1995), who found a significant achievement difference favoring students who were matched with their preferred amount of instruction over those who were not. However, it is consistent with results reported by Hannafin and Sullivan (1994), who did not find an achievement advantage for matching students to their preferred amount.

The difference in achievement results in the studies of matched and unmatched preferences for amount of instruction may be due to the differing nature of the subjects and subject matter in the studies. Shute and Gluck (1995) found that a higher level of education and greater interest in the subject matter were the two key factors associated with more exploratory behavior (i.e., selection of more learning options) and with higher posttest achievement by the adult subjects in their research. Freitag and Sullivan's (1995) subjects, who performed significantly better under the matched condition, were college graduates who volunteered to use a training program that was directly related to their jobs. These subjects had an education level higher than the college undergraduate students in the present study and considerably higher than the high school students in the Hannafin and Sullivan (1994) research. That they volunteered for their program and that it provided relevant on-the-job training for them suggests that they may well have had greater interest in their subject matter than the present subjects and those in the Hannafin and Sullivan (1995) study, both of whom were completing programs in required school courses. Thus, as with Shute and Gluck's (1994) subjects, differences in educational level and in interest in the subject may have been important factors affecting the relationship between learner preferences and their achievement.

The present results indicate that full programs, as one might expect, are more effective than lean ones when subjects do not have the option to add or delete instruction and practice in their particular program version. This finding, unlike the one for matching students with their preferred amount of instruction, is consistent with the results obtained by Freitag and Sullivan (1995) with college graduates in a corporate training program. The procedures in the two studies were similar in that subjects in both the full and lean versions were under program control -- that is, the program versions were linear or fixed in length.

The results especially illustrate the value of practice in enhancing learner performance, since amount of practice was the only instructional element varied between the full and lean program versions. Students in the full version averaged 14 minutes longer in the program than those in the lean one, an 11 percent difference, but this difference in time was not statistically significant. Yet, the full-version subjects averaged 22 percent higher than lean-version subjects on the posttest, a difference that was highly significant. Clearly, the additional practice in the full version was a very efficient factor in improving student achievement.

Giving learners control over the amount of instruction and practice they receive in full and lean versions, however, appears to moderate the achievement advantage favoring the full version when

program lengths are fixed under program control. Whereas the present researchers and Freitag and Sullivan (1995) obtained results favoring the full version in fixed-length programs, the results are less consistent in studies in which learners have partial control over the amount of instruction and practice they receive in the full and lean versions. Only one study (Hannafin and Sullivan, 1995) of four in which learners were given partial control over the length of full and lean programs yielded a clear-cut achievement advantage for the full version over the lean one. In the remaining three studies (Hannafin and Sullivan, 1994; Hicken et al., 1992; Igoe, 1993), learner control in both the full and lean versions did not result in a significant achievement difference for the full version, although the difference favoring the full version in the Hicken study did approach significance ($p = .052$).

The primary reason for the findings favoring full over lean programs when the program length is fixed, but the less consistent results when learner control is available, appears to be the ability that students have to adjust the amount of instruction and practice under the learner-control condition. Under fixed or program control, learners receive much more instruction in a full program than in a lean one. Under learner control, however, subjects in a full program can choose to delete optional elements as they work through the program, whereas those in the lean program can compensate for their lesser amount of basic instruction by choosing to add optional instruction that has the potential to make their program more equivalent in length to the full version. Subjects in the full program versions in learner-control studies (Hannafin and Sullivan, 1994; Hannafin and Sullivan, 1995; Igoe, 1993; Hicken, Sullivan, and Klein, 1992) have typically chosen to by-pass from 10 to 20 percent of the optional instruction available to them, while those in the lean versions have chosen to add from 30 to 70 percent of the optional instruction to their versions. Thus, the difference in the amount of instruction and practice between full and lean versions is greatly reduced when learner control is available. Igoe's results also suggest that the advantage of a full version over a lean one under learner control is especially mitigated when learners are highly motivated, because of the positive relationship between learner motivation and the amount of optional instruction that learners select in a lean program.

Subjects who preferred a high amount of instruction had more favorable overall attitudes toward the program, agreeing more strongly with positive statements on all eight items and significantly more strongly on five of the eight. Interestingly, the consistent attitude pattern revealing more positive attitudes among high-preference subjects than among low-preference subjects occurred as a main effect difference across full and lean programs. Rather than this pattern of main-effect differences, it seems more logical to expect an attitude pattern reflecting statistical interactions in which the high-preference subjects respond more positively than low-preference ones to the full program but less positively to the lean program. However, high-preference subjects consistently responded more favorably to the attitude items irrespective of the program version that they received.

Overall, subjects had more favorable attitudes toward the lean version of the program than toward the full version, even though they had higher achievement in the full version. This finding,

combined with the failure of pre-treatment preferences to predict posttest achievement, add to a growing body of evidence that students' preferences and judgments often may not be good indicators of the way they learn best. Snow and Peterson (1980) noted that many students may prefer an instructional method that requires less work, as a lean program would, over one from which they will learn better. Carrier (1984) also pointed out that students often prefer a less effective method or make poor decisions about the instruction they need. More recently, several researchers have found that their subjects had more positive attitudes toward instructional methods that provided more learner control (Igoe, 1993) or more social interaction (Crooks, 1995; Jones, 1996; Snyder and Sullivan, 1995) than toward alternative approaches that were as effective or significantly more so.

Several conclusions may be drawn from the present research in combination with recent related studies using full and lean versions of an instructional program. A single version of a program is less expensive to develop and use than two alternate versions, and a full program that provides more learner practice clearly is a more effective choice than a leaner one for achievement purposes. Thus, the most cost-effective type of program for yielding acceptable learner achievement normally is likely to be a relatively full one. However, learner attitudes often are less positive toward a full program than a lean one, even though the full program may yield higher achievement. Finally, the present study and recent research by Hannafin and Sullivan (1994) suggest that pre-instructional preferences of school and university students, at least with regard to amount of instruction, are not good predictors of their post-instructional performance.

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Table 1

Mean Posttest Scores By Program Mode and Matching Condition

Program Mode		Matching Condition: Matched	Matching Condition: Unmatched	Total
Full	M	28.33	28.88	28.59
	SD	(4.70)	(5.56)	(5.09)
Lean	M	23.60	23.26	23.42
	SD	(5.53)	(5.23)	(5.35)
Total	M	26.67	25.86	25.99
	SD	(5.60)	(6.06)	(5.82)

Note: Cell sizes ranged from 43 to 51

Table 2

Attitude Scores by Program Mode and Preference

Item	Program Mode			Preference		
	Full	Lean	p	High	Low	p
1. The program was easy.	2.55	2.10	.01	2.29	2.36	ns
2. I would like to learn more about Competency Based Instruction.	2.13	2.06	ns	1.94	2.27	.01
3. I tried hard to do well in the program.	1.76	1.72	ns	1.65	1.83	ns
4. I would tell other students to use this program if they wanted to learn about Competency Based Instruction.	2.27	1.97	.05	1.93	2.33	.01
5. Overall, I liked the program.	2.23	2.02	ns	1.96	2.32	.01
6. I would like to use programs like this one again.	2.26	2.03	ns	2.00	2.32	.05
7. I like this program better in computer form than in book form.	2.27	2.02	ns	2.11	2.18	ns
8. If I had to work on another computer program, I would prefer one that provided a lot of instruction and practice.	2.25	2.07	ns	2.02	2.32	.05
Overall means	2.22	2.00		1.99	2.24	

Note: All items measured on a five-point scale from 1 to 5 (Strongly Agree to Strongly Disagree) -- thus, lower scores are more positive. ns = $p > .05$.